

# Cerebral hemisphere

## ◆ Sulcus / Fissure

### ◆ Central

#### ◆ Precentral gyrus

#### ◆ Postcentral gyrus

### ◆ Lateral (cerebral)

### ◆ Parieto-occipital

## ◆ Cerebral cortex (gray matter)

### ◆ Frontal lobe

### ◆ Parietal lobe

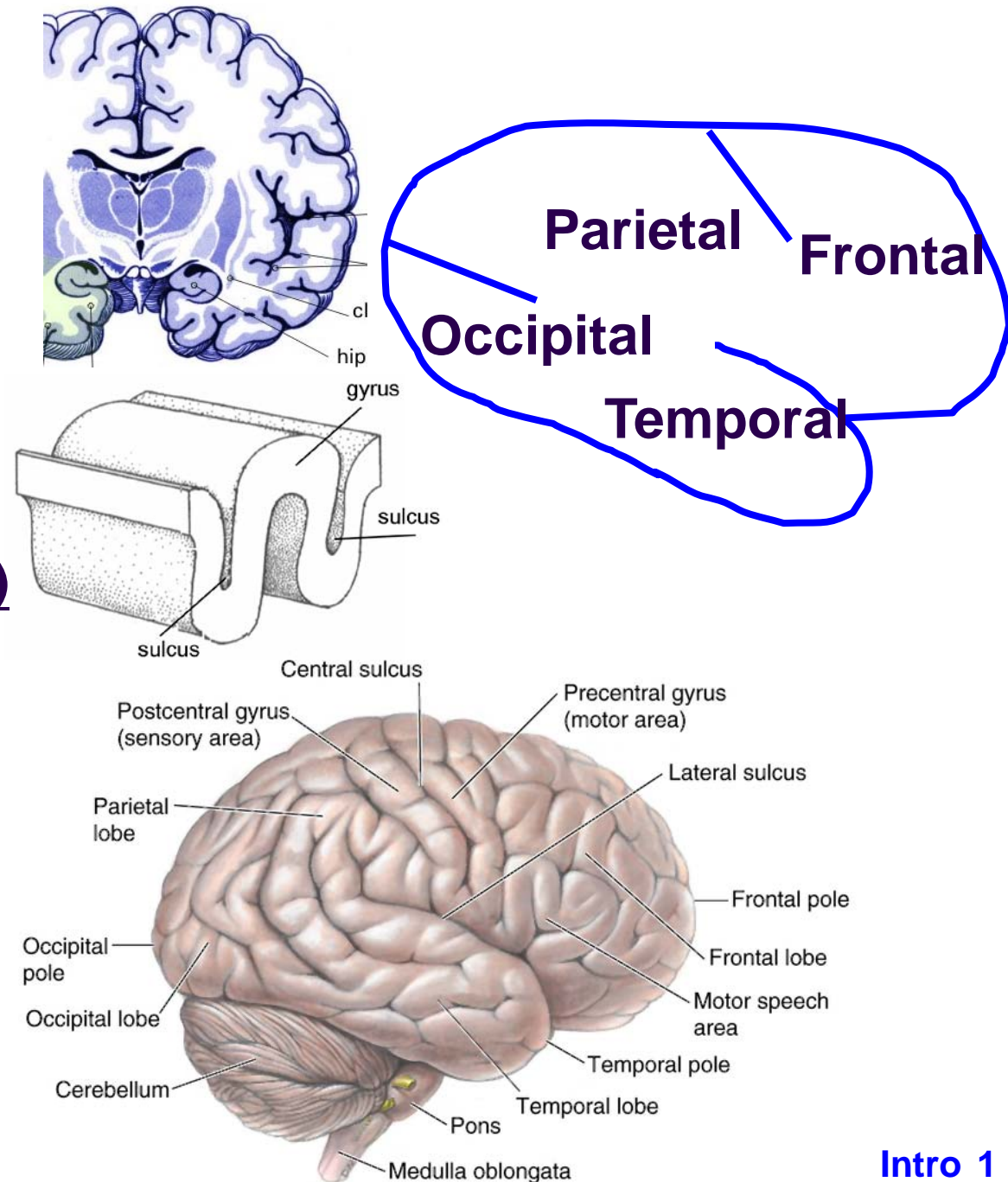
### ◆ Temporal lobe

#### ◆ Insula

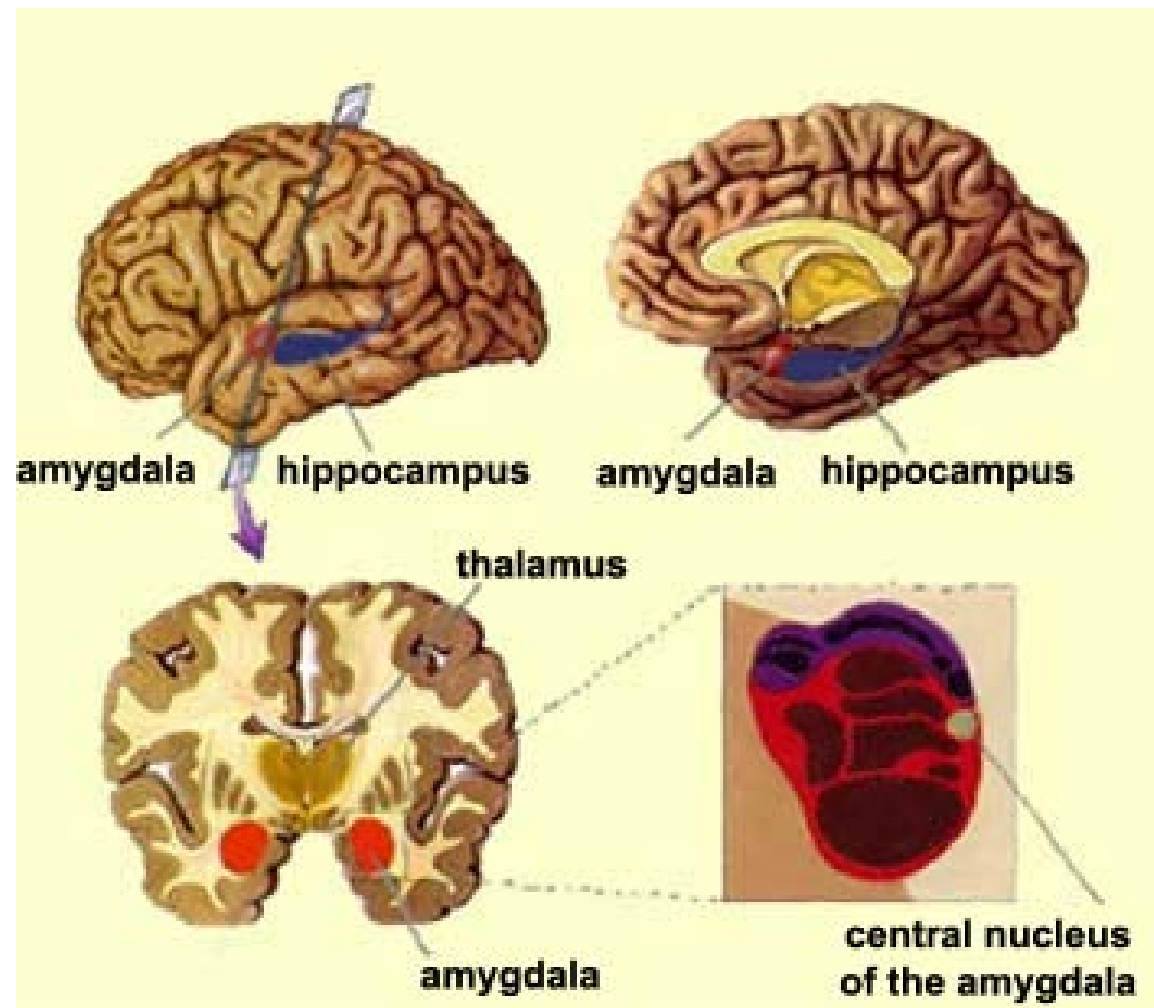
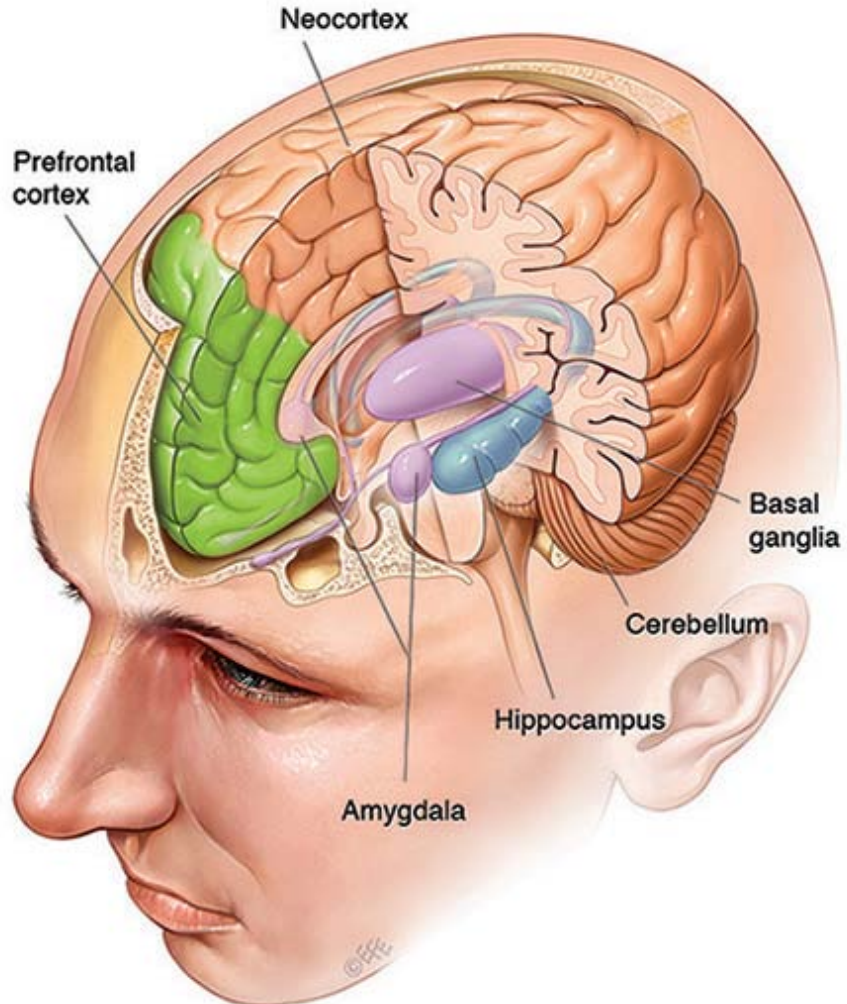
#### ◆ Amygdala

#### ◆ Hippocampus

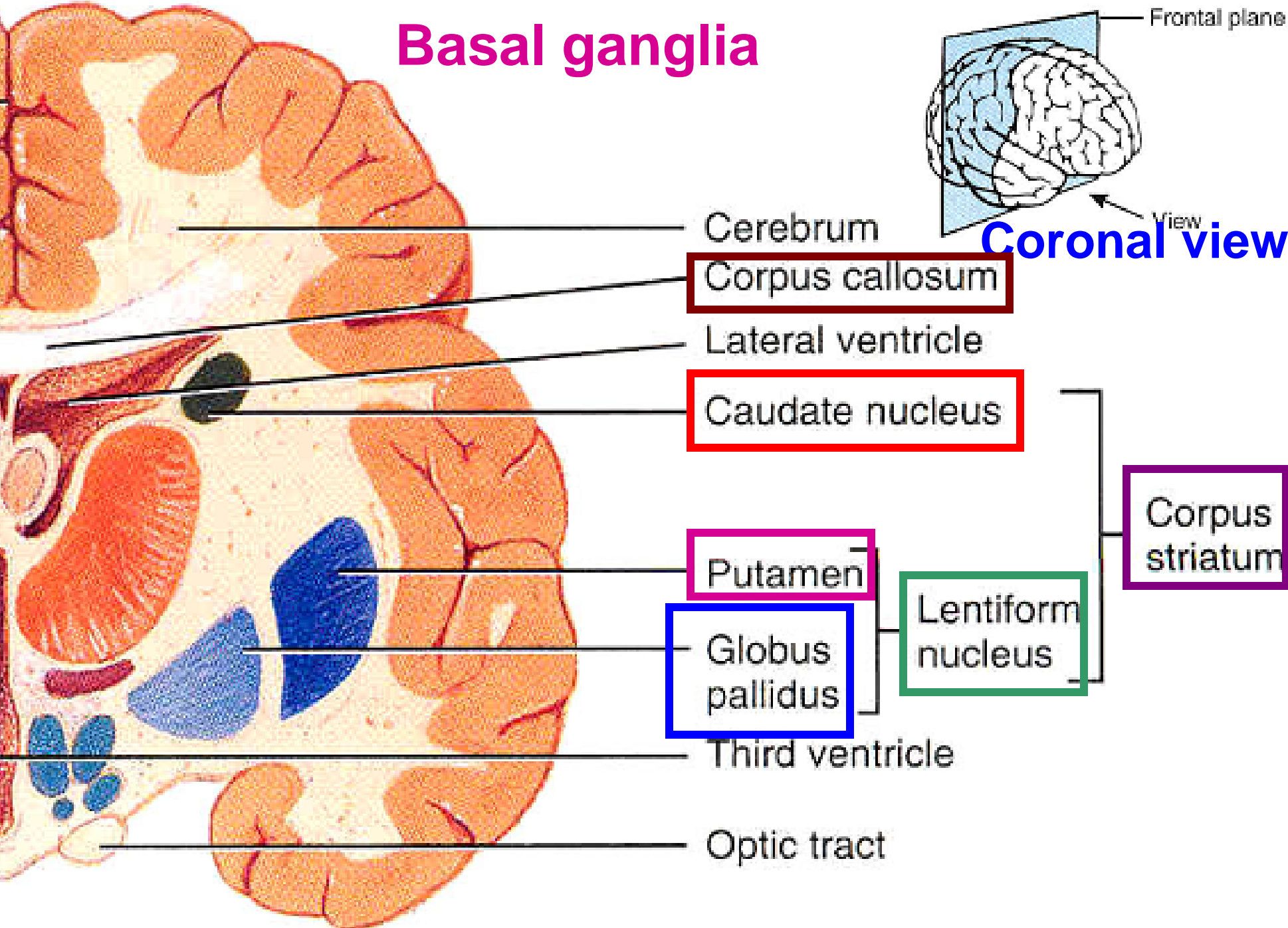
### ◆ Occipital lobe



# Temporal lobe (mesial surface): Amygdala and Hippocampus



# Basal ganglia



# Brain: Diencephalon

Longitudinal fissure

Septum pellucidum

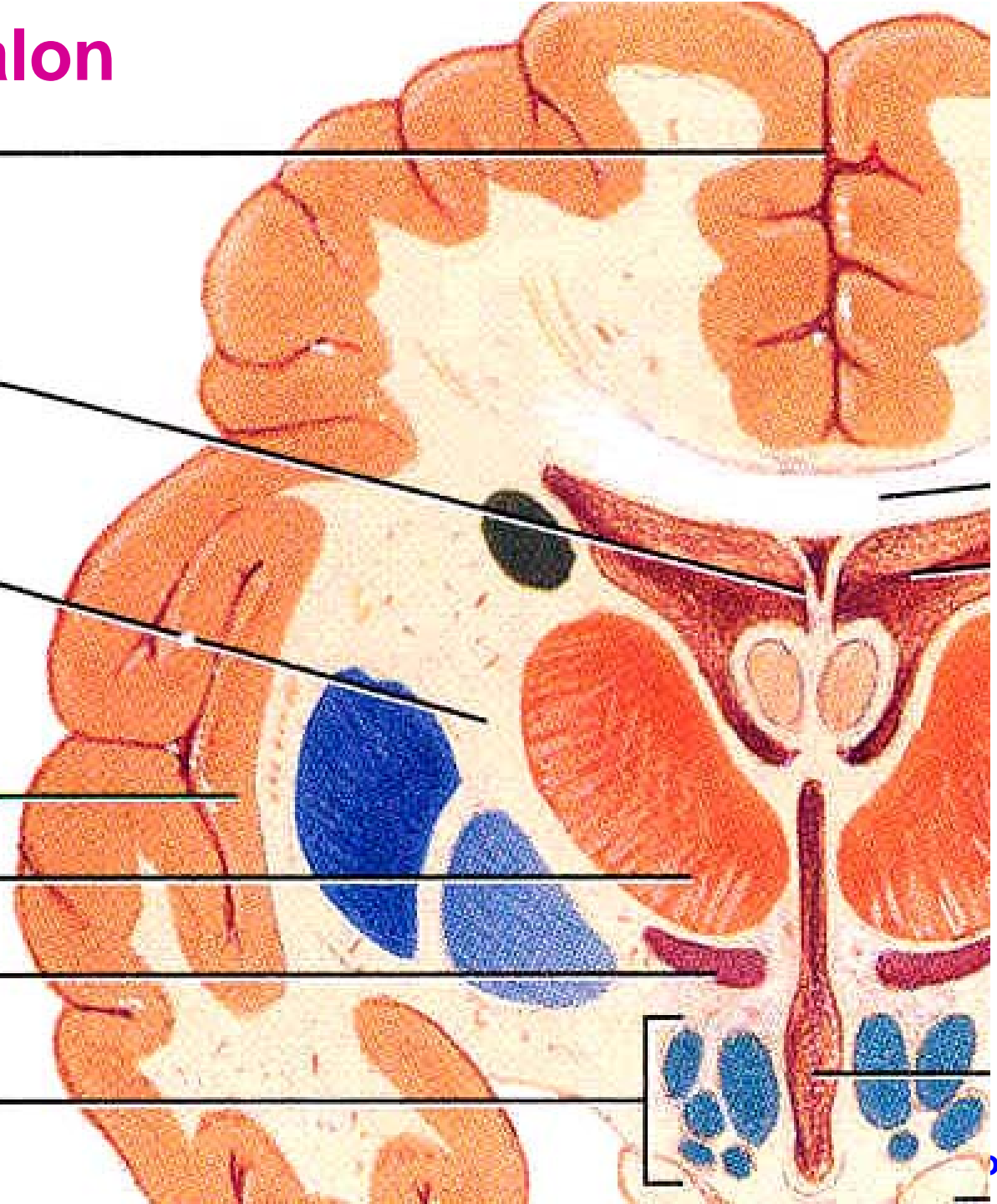
Internal capsule

Insula

Thalamus

Subthalamic nucleus

Hypothalamus



# Brainstem

Infundibulum

Midbrain

Pons

Middle cerebellar peduncle

Junction of pons and medulla

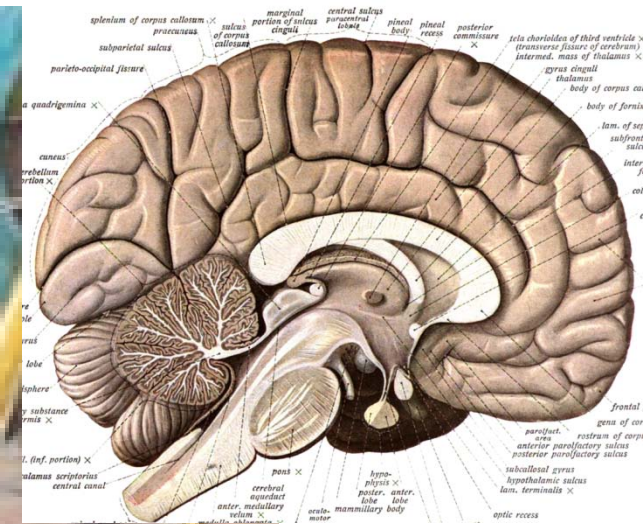
Choroid plexus of 4th ventricle

Lateral recess of 4th ventricle

Medulla

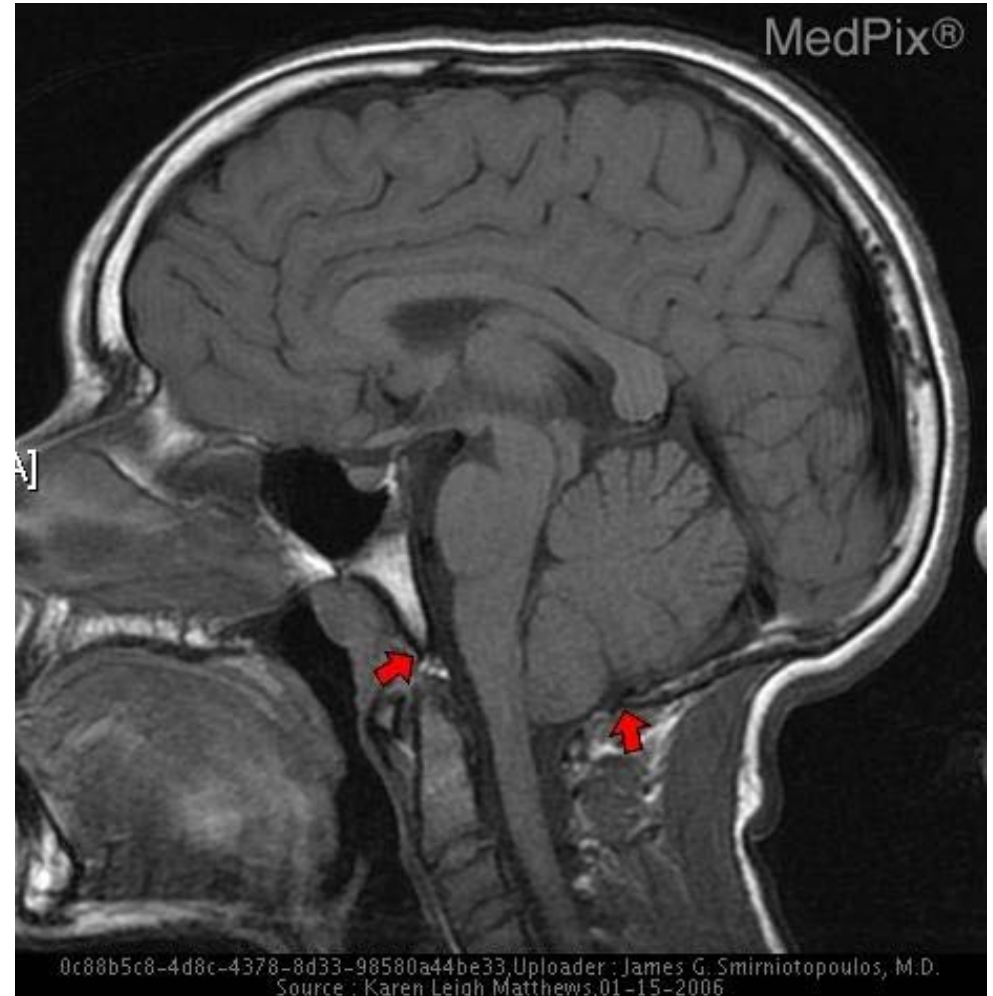
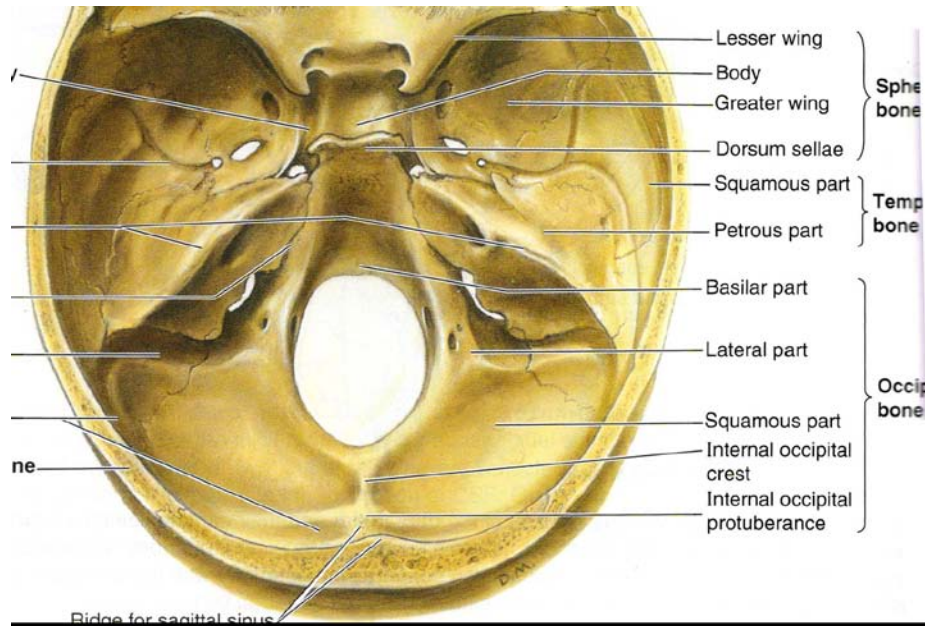
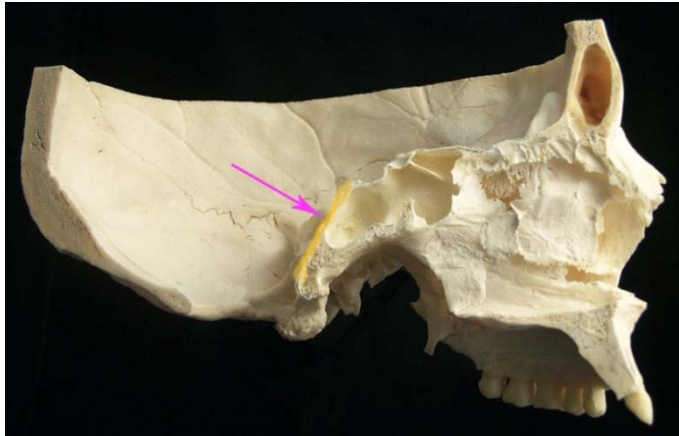
Hypoglossal nerve (CN XII)

Chiasm



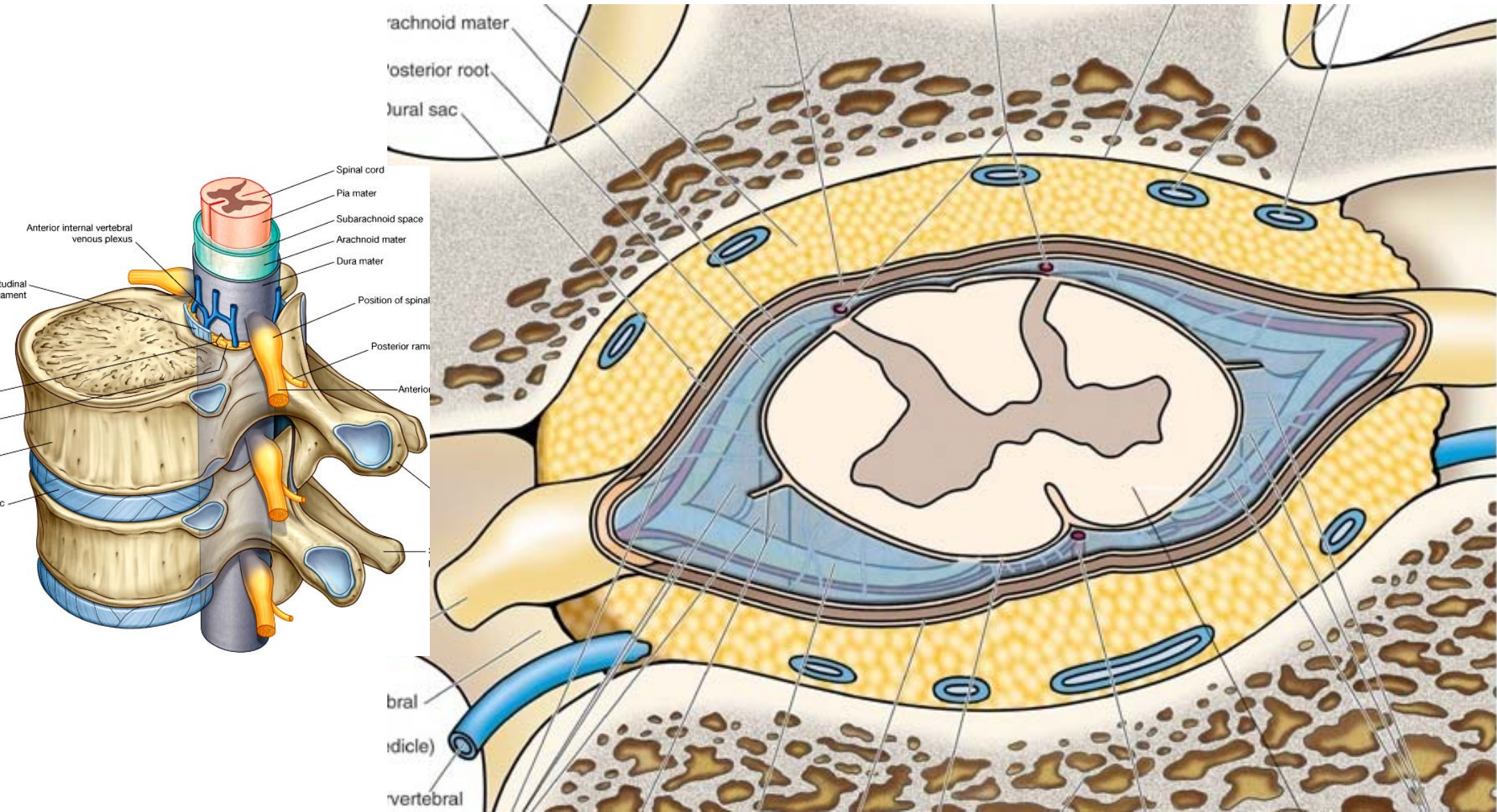
# Brainstem

## ◆ Brainstem on occipital bone (basilar part, clivus)



# Spinal cord

## ◆ Vertebral canal; Gray matter, White matter



# Spinal cord

White substance (matter)

Gray substance (matter)

**Dorsal**

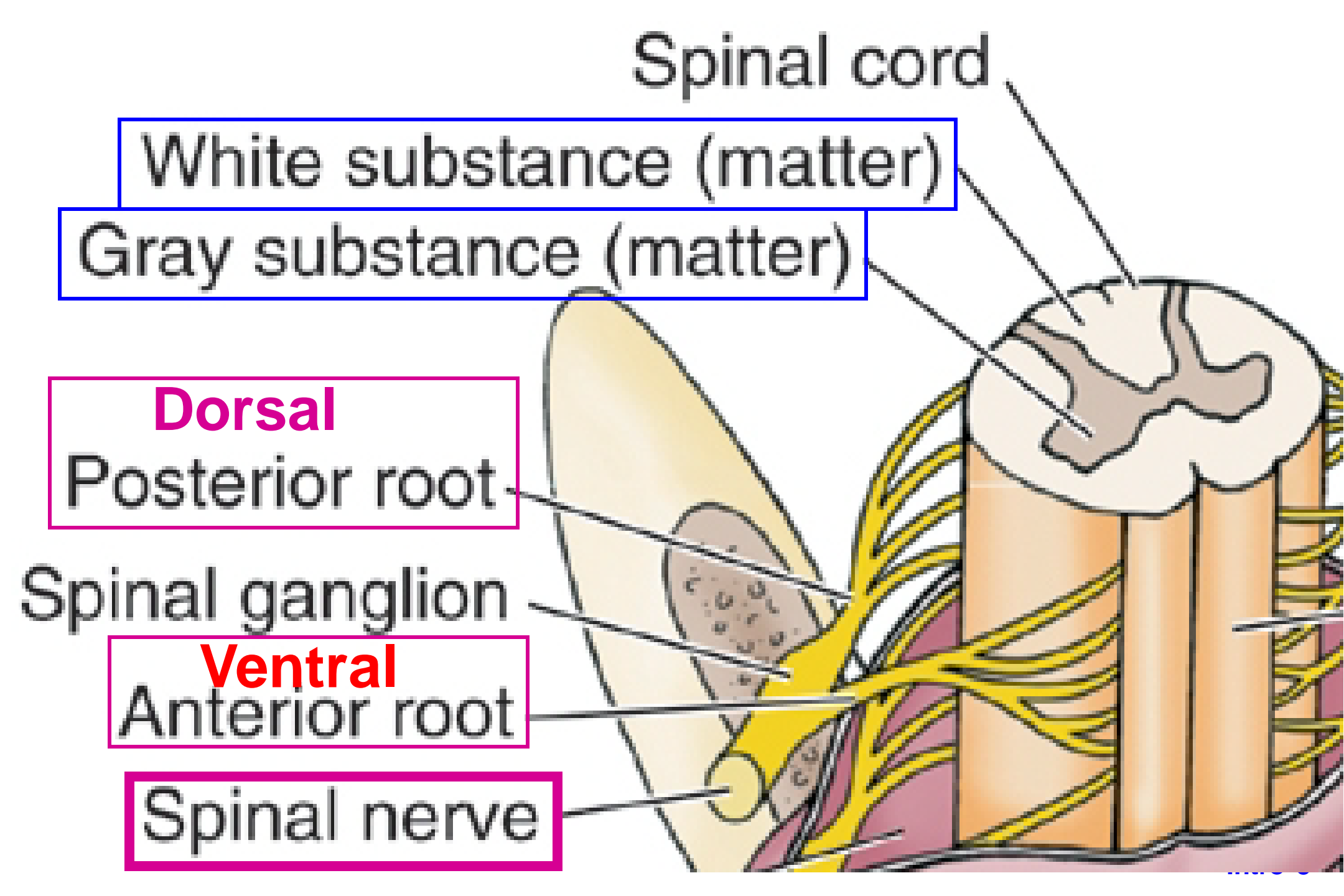
Posterior root

Spinal ganglion

**Ventral**

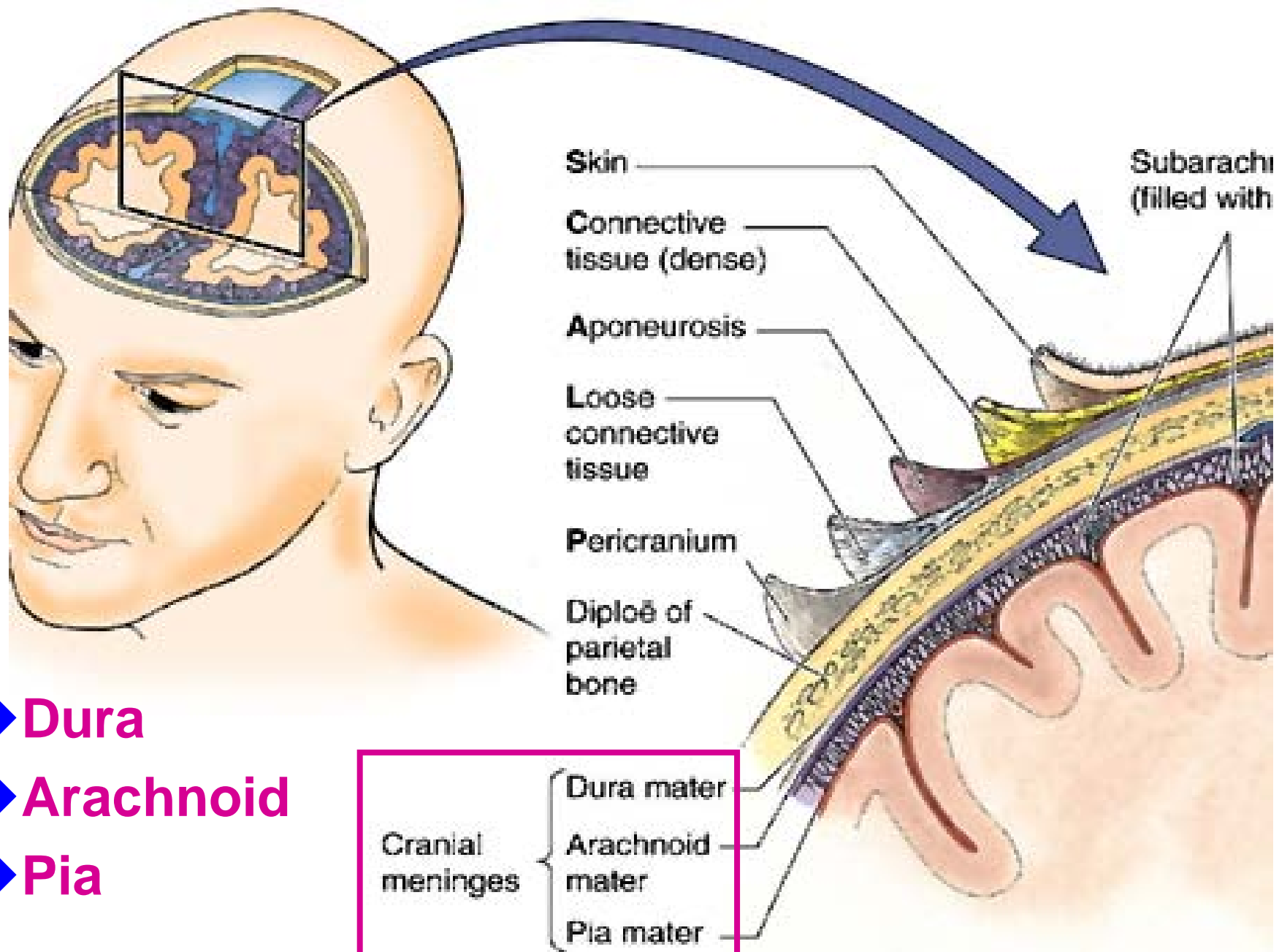
Anterior root

Spinal nerve





# Meninges: covering of the brain tissues

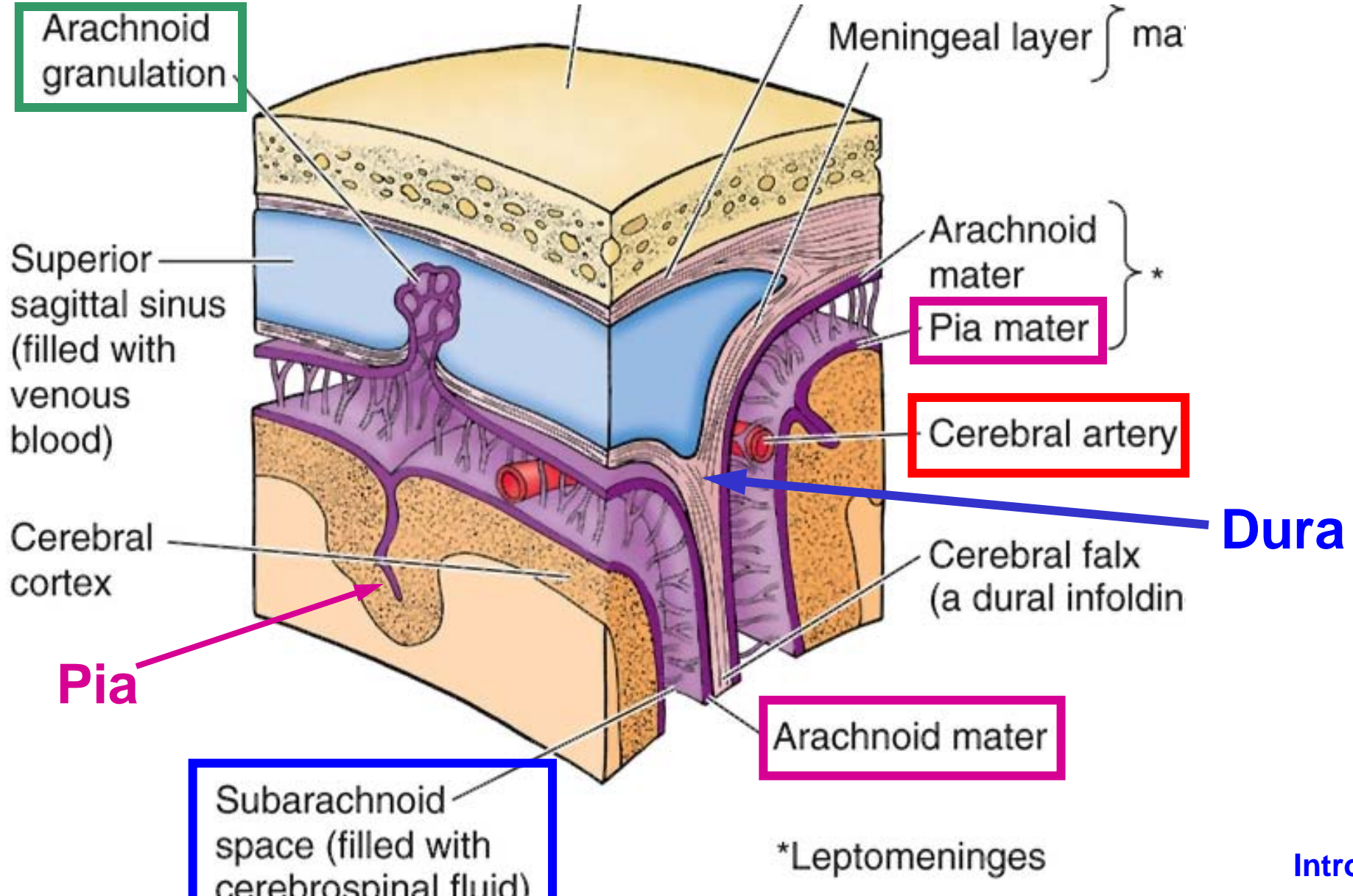


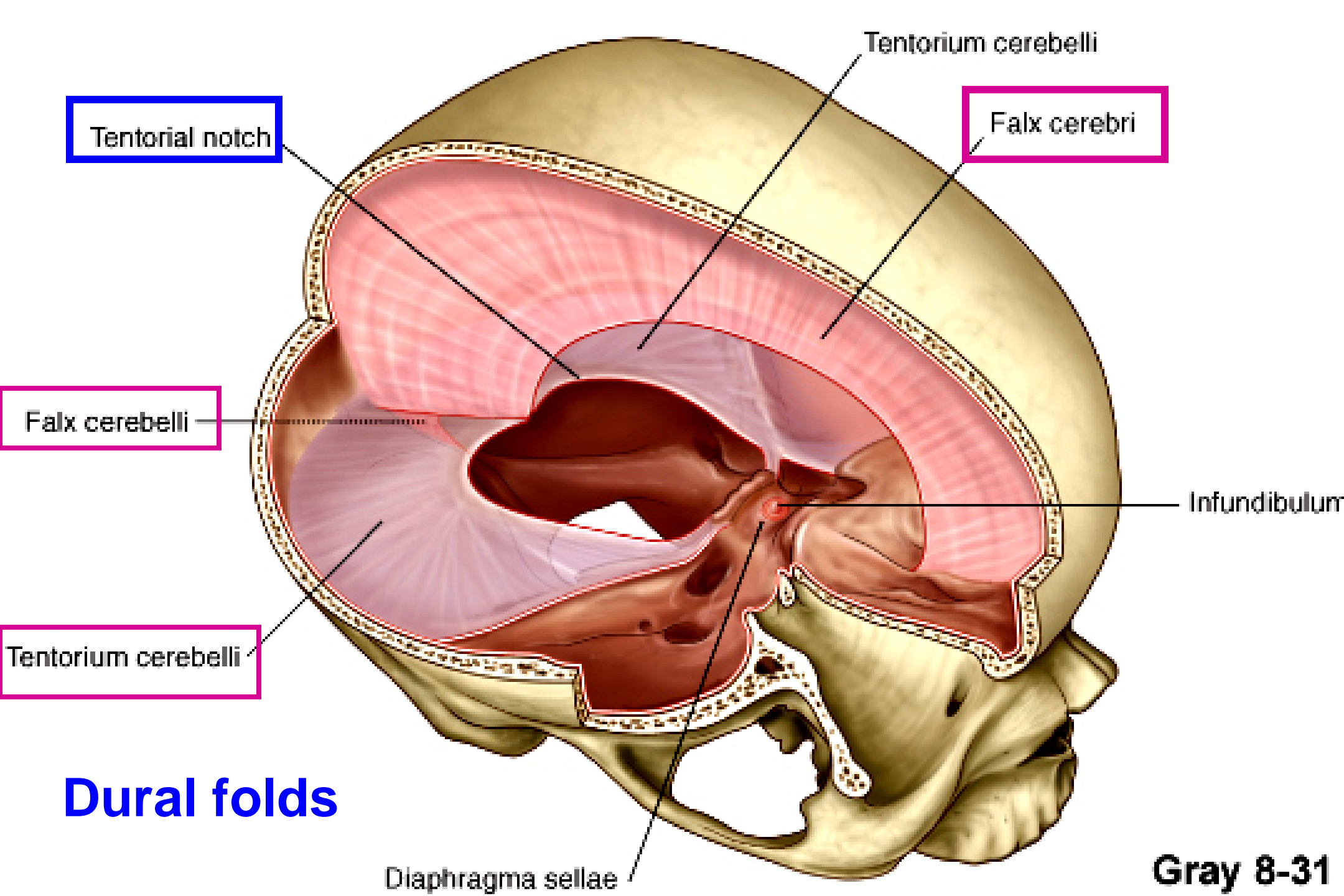
- ◆ **Dura**
- ◆ **Arachnoid**
- ◆ **Pia**

Cranial meninges

- Dura mater
- Arachnoid mater
- Pia mater

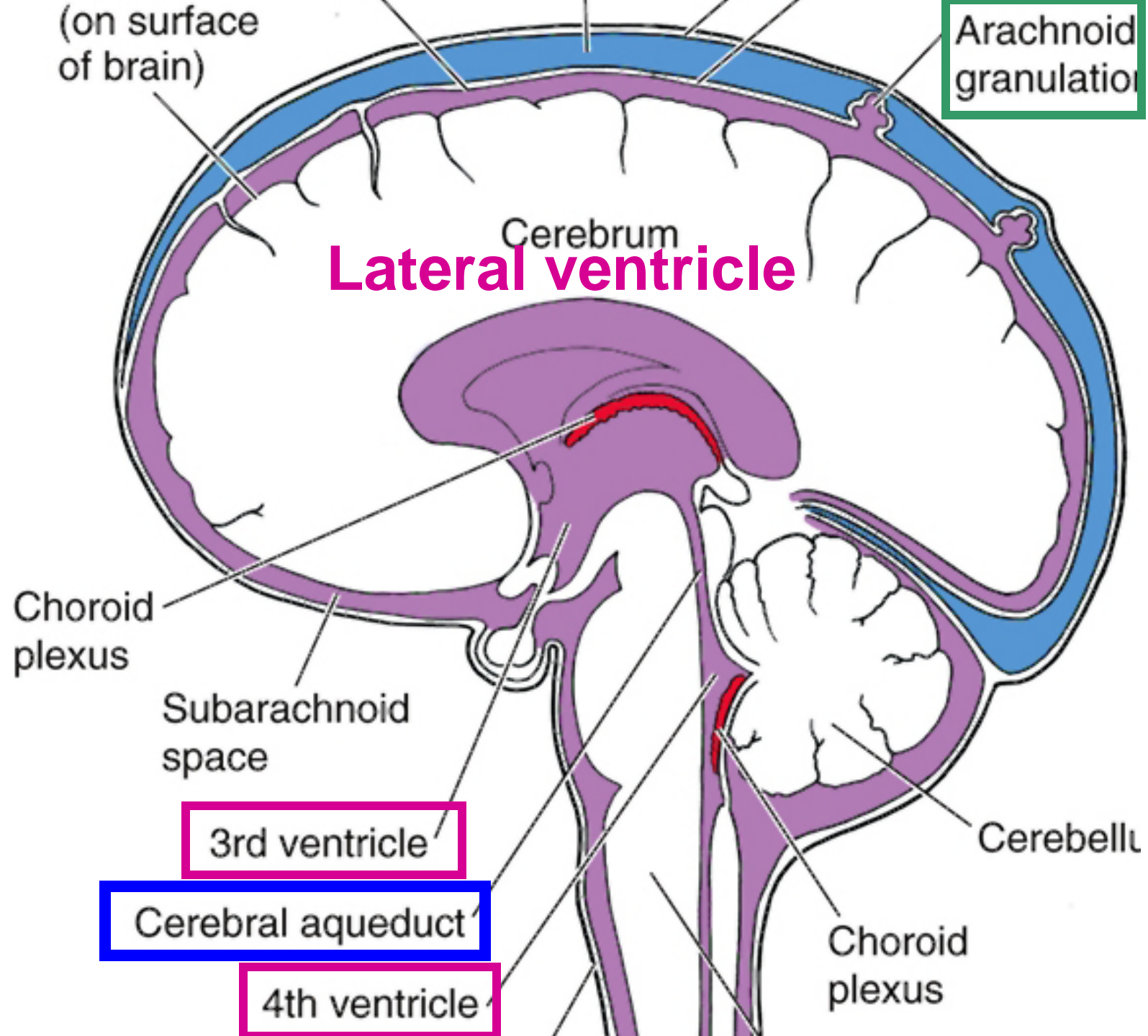
- ◆ Arachnoid mater: Subarachnoid space (CSF, arteries)
- ◆ Pia mater

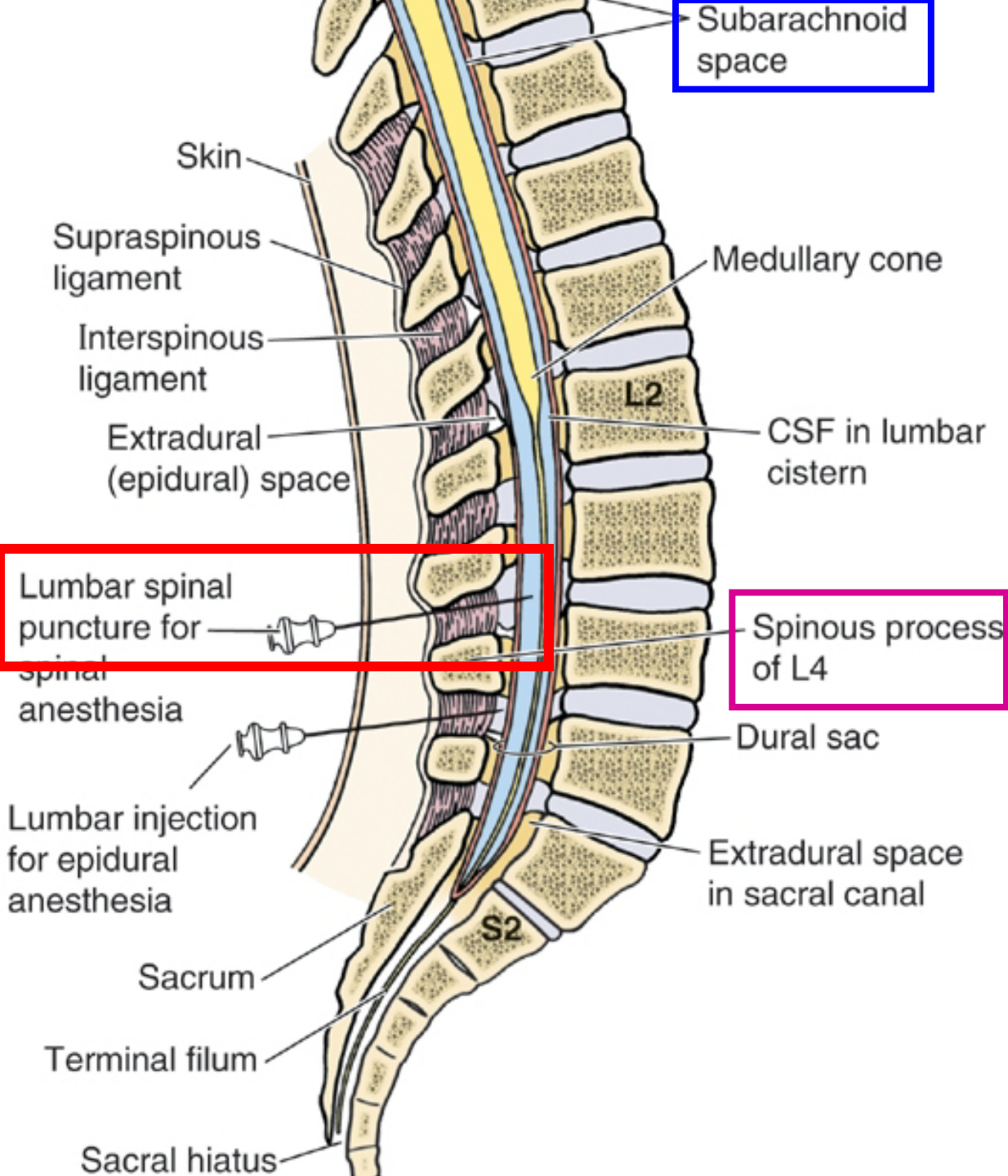




# CSF circulation

- ◆ Production: Choroid plexuses in ventricles →
- ◆ lateral ventricle →
- ◆ foramen Monro (interventricular foramen) →
- ◆ 3rd ventricle →
- ◆ cerebral aqueduct →
- ◆ 4th ventricle: Median and Lateral apertures →
- ◆ subarachnoid space (cistern) →
- ◆ arachnoid granulation →
- ◆ superior sagittal sinus

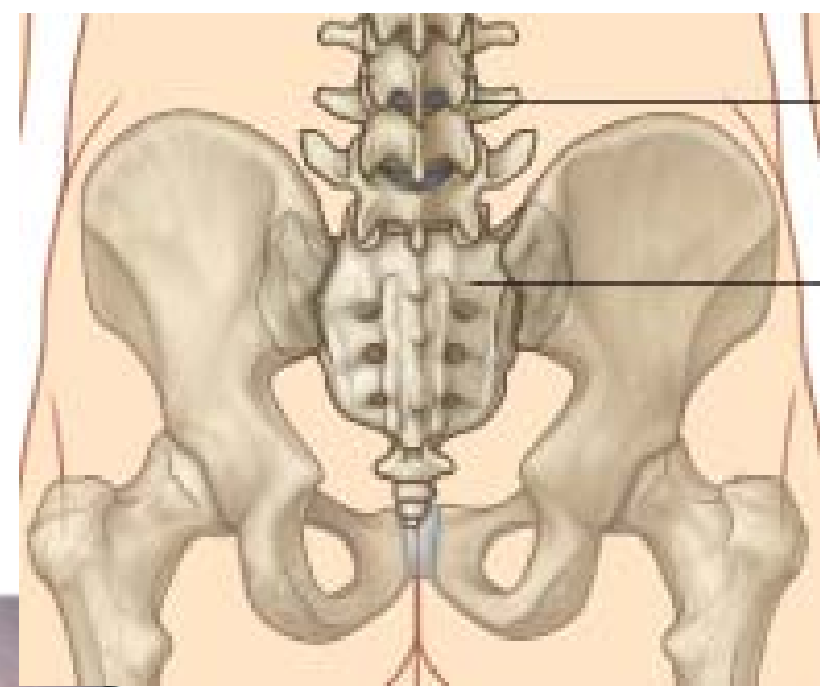




# Lumbar puncture

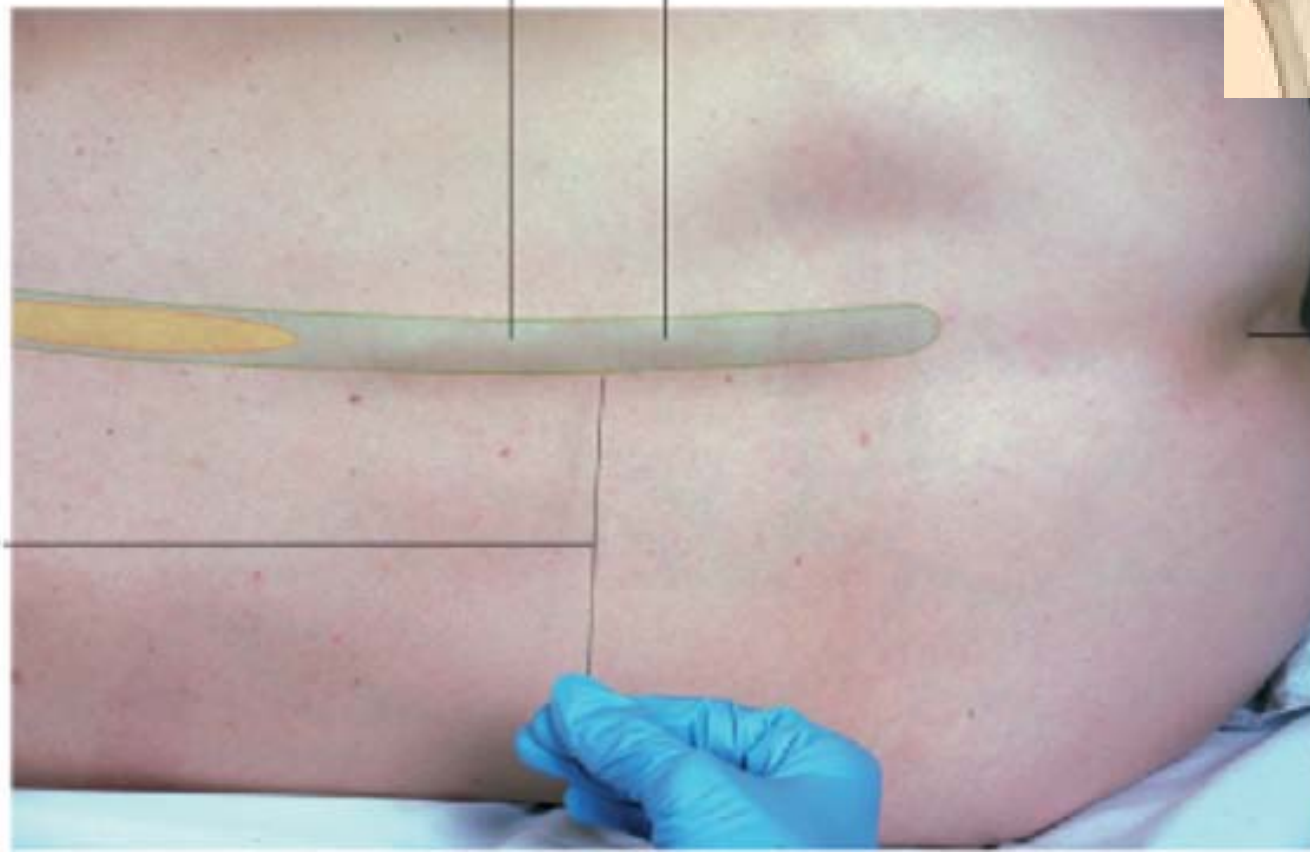
- ◆ For CSF in the subarachnoid space
- ◆ Usually at the L 4-5 intervertebral space

# Lumbar puncture



LIV vertebral spinous process

LV vertebral spinous process



Tip of coccyx

Needle

# Cerebral arteries

- ◆ in subarchnoid space
- ◆ Circle of Willis (cerebral circle)
- ◆ Internal carotid artery (ICA) system
  - ◆ Anterior cerebral artery (ACA)
  - ◆ Middle cerebral artery (MCA)
- ◆ Vertebral artery system
  - ◆ Posterior cerebral artery (PCA)
  - ◆ Basilar artery
- ◆ Communicating arteries: anterior (Acom), posterior (Pcom)



Anterior communicating

Anterior cerebral

Middle cerebral

Internal carotid

Posterior communicating

Posterior cerebral

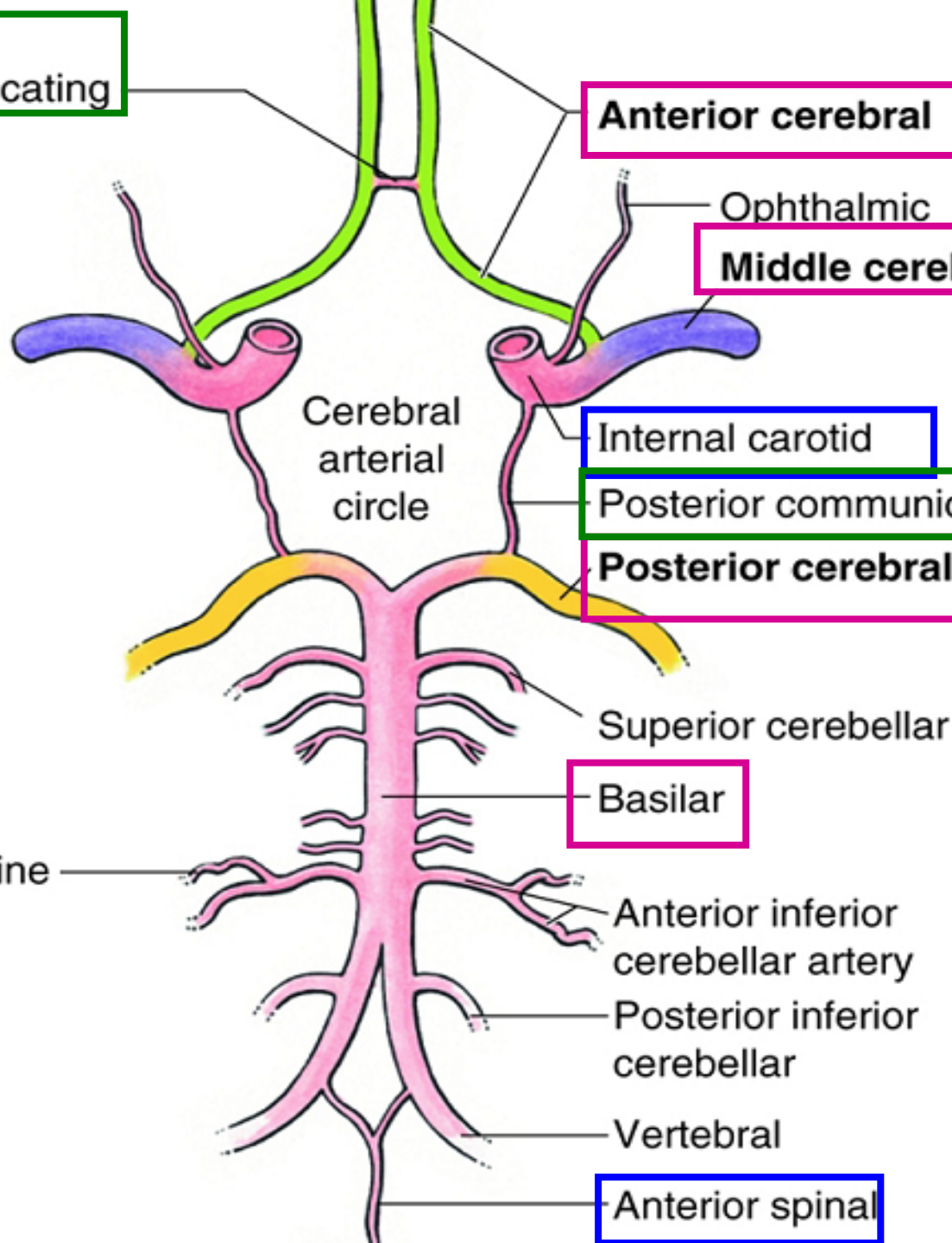
Basilar

Anterior inferior cerebellar artery

Posterior inferior cerebellar

Vertebral

Anterior spinal



Cerebral arterial circle

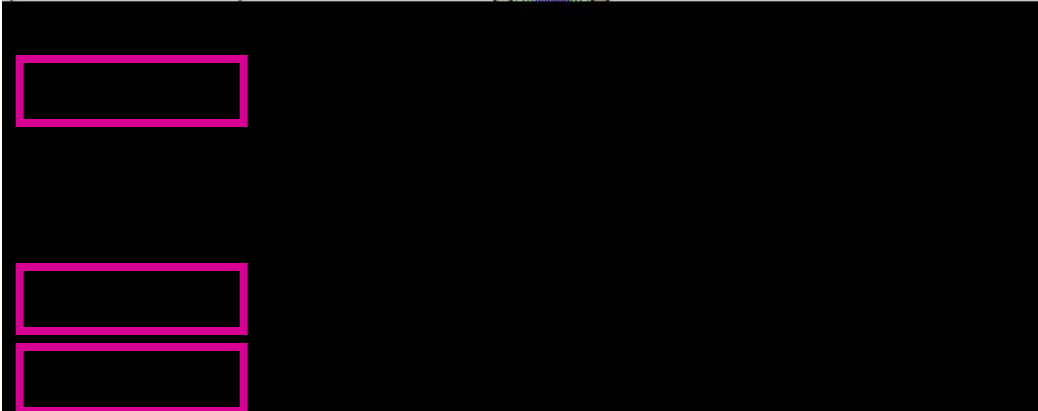
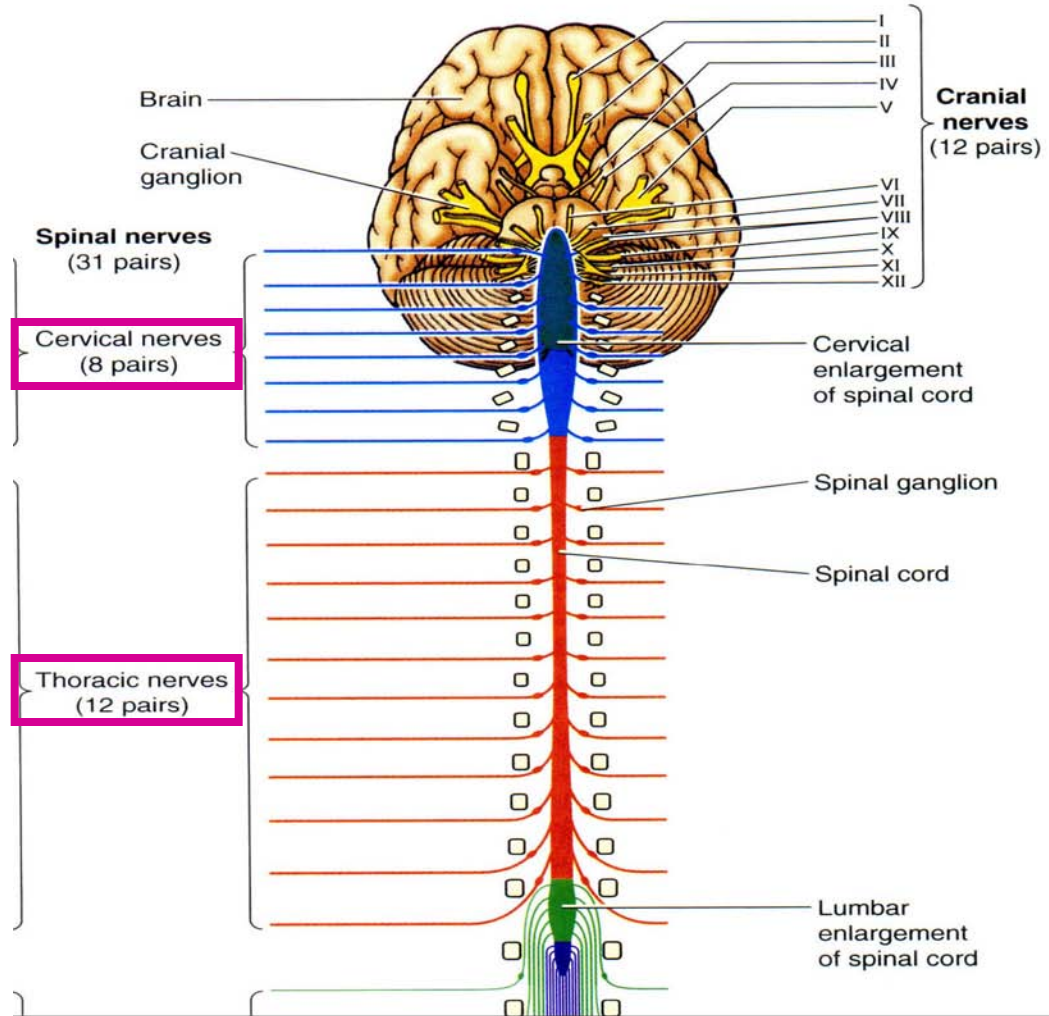
Ophthalmic

Labyrinthine (internal acoustic) artery

Superior cerebellar

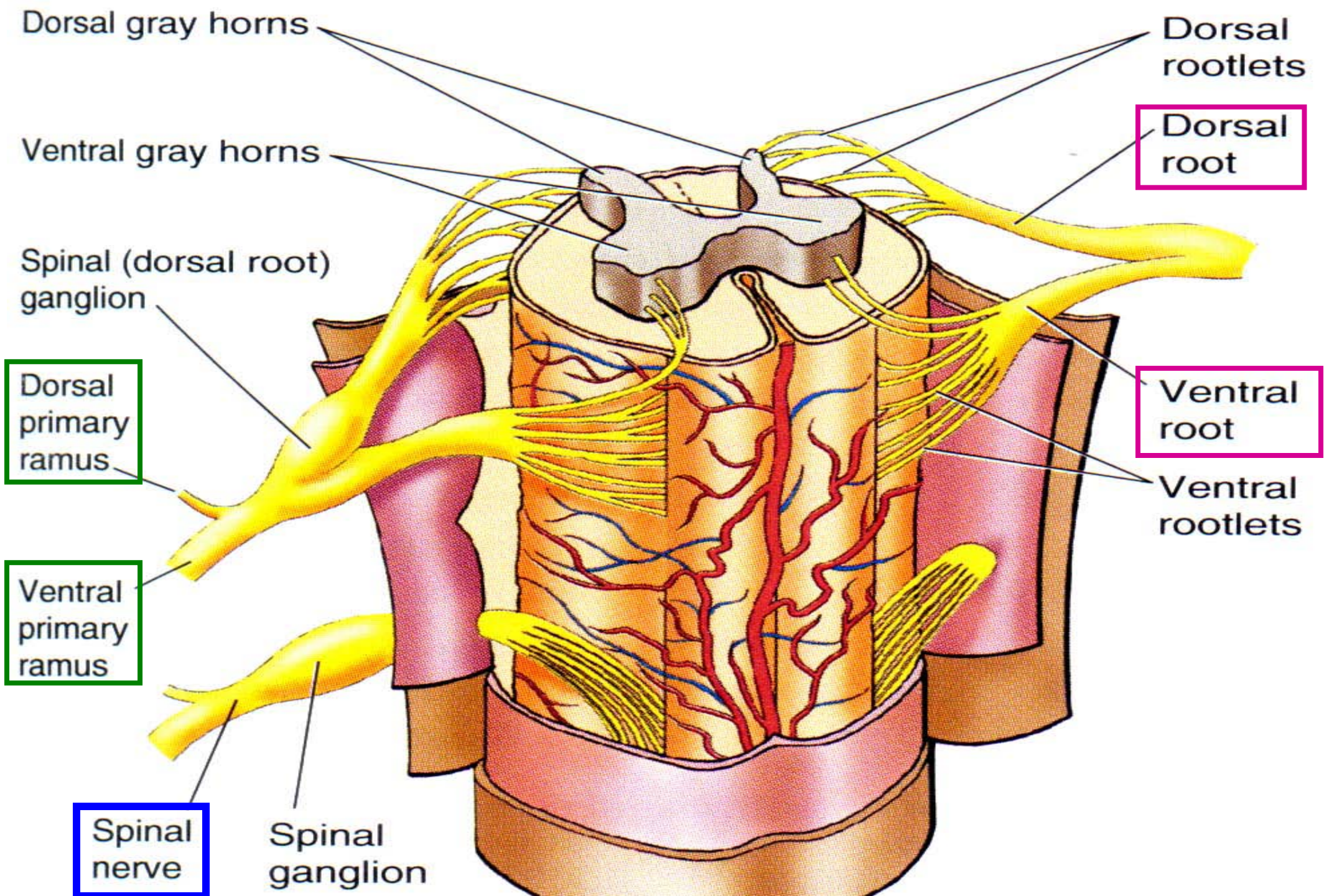
# Peripheral Nervous system

- ◆ Spinal nerves
  - ◆ 31 pairs: Cervical (C, 8), Thoracic (T, 12), Lumbar (L, 5), Sacral (S, 5), Coccyx (Cx, 1)
- ◆ Cranial nerves
  - ◆ 12 pairs
  - ◆ [Cr N. I & Cr N. II: considered as CNS extension]
- ◆ Contents
  - ◆ General Motor / Sensory nerves
  - ◆ Autonomic nerves (Visceral components)



# Spinal nerves: functional components

- ◆ A spinal nerve contains
  - ◆ Ventral (anterior) roots
    - ◆ Motor fibers from motor neurons in anterior horn
  - ◆ Dorsal (Posterior) roots
    - ◆ Sensory fibers from spinal ganglion to dorsal horn
- ◆ To become a Mixed spinal nerves:
  - ◆ Dorsal (posterior) ramus
    - ◆ to vertebral column & back
  - ◆ Ventral (anterior) ramus
    - ◆ trunk (ant. & lat.), upper & lower limbs



Ventral primary ramus (intercostal nerve)

Dorsal primary ramus

Dorsal branch of posterior intercostal artery

Internal intercostal membrane

External intercostal muscle

Internal intercostal muscle

Lateral cutaneous branch

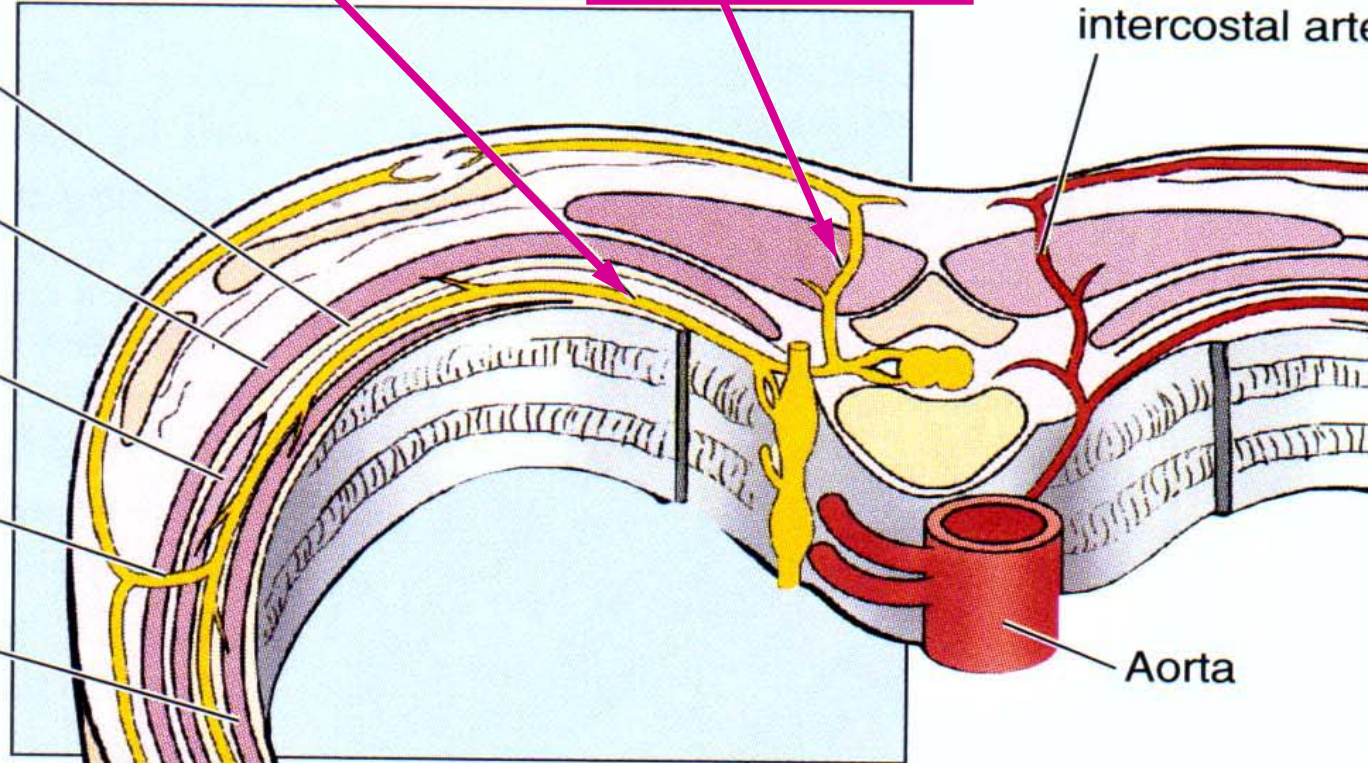
Innermost intercostal muscle

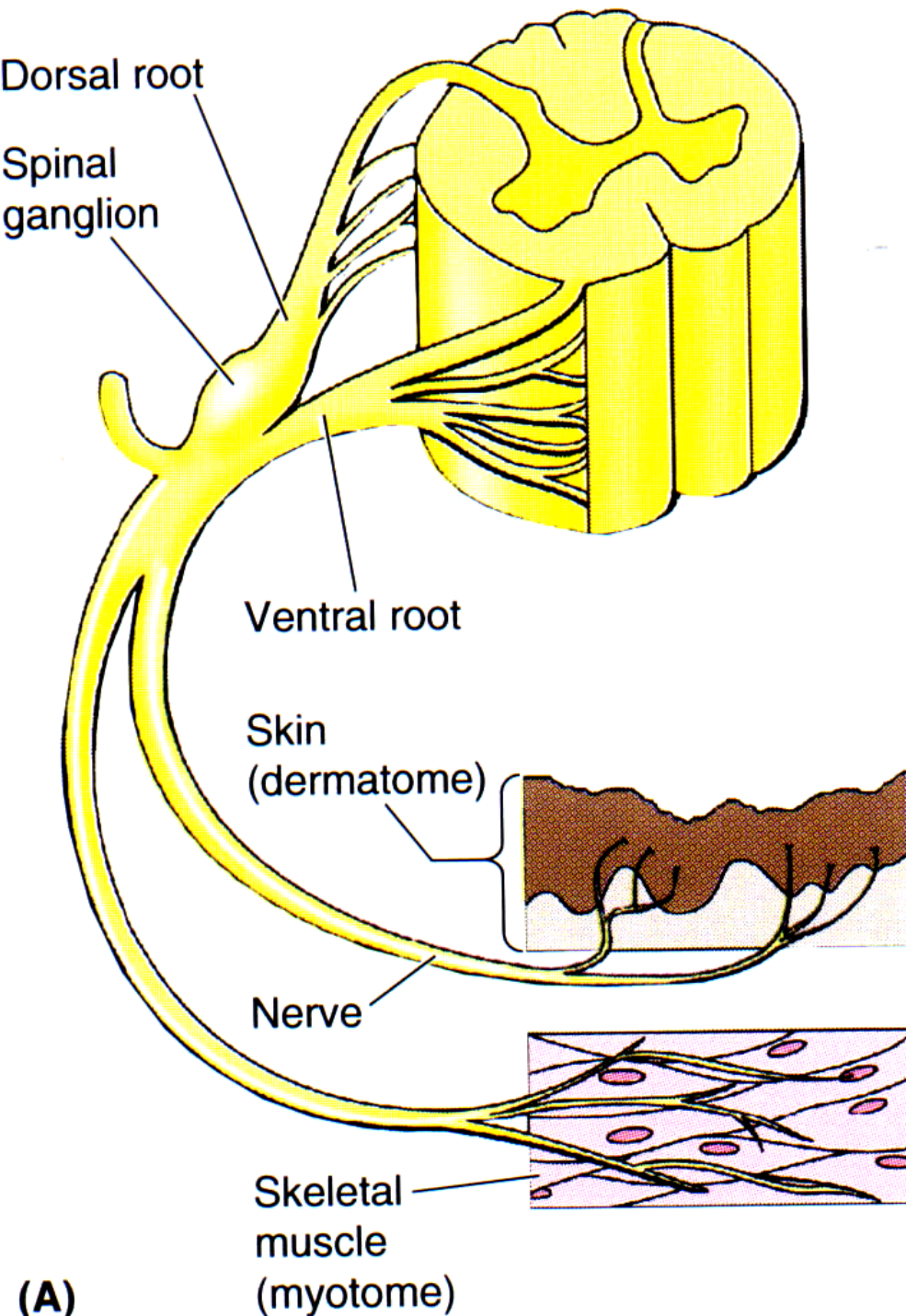
Transverse thoracic muscle

External intercostal membrane

Aorta

Anterior (cutaneous) branch





## Territory of innervation

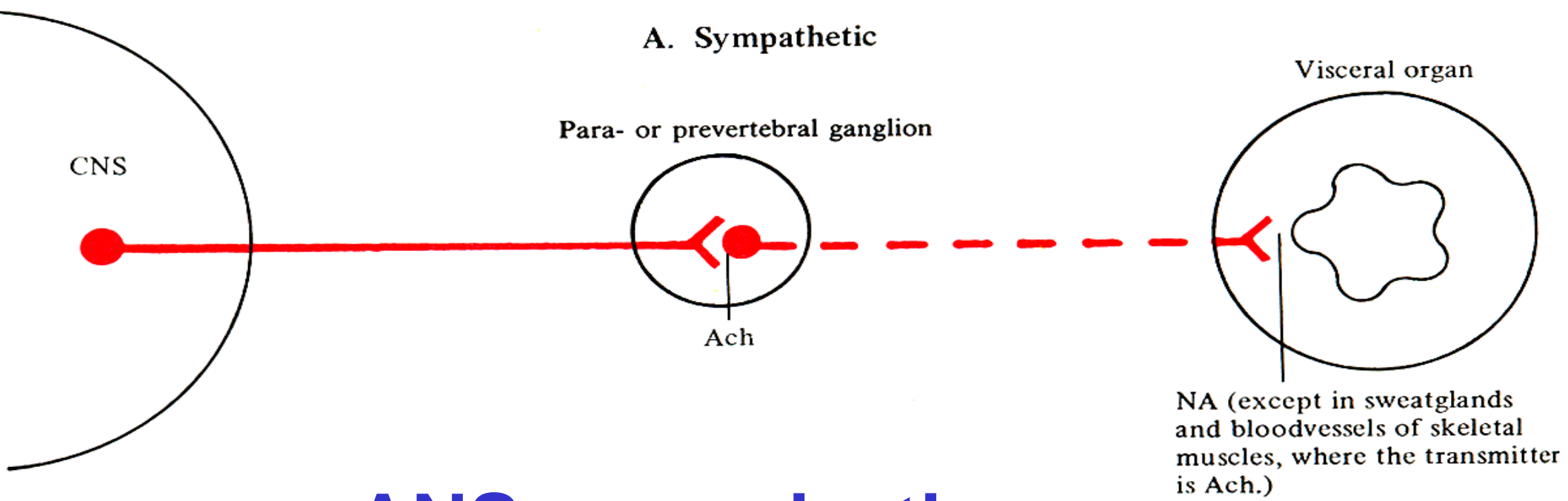
- ◆ Spinal nerves
  - ◆ Dermatome: skin innervation
  - ◆ Myotome: muscle innervation
- ◆ Peripheral: combination of various dermatome + myotome

# Autonomic nervous system (ANS)

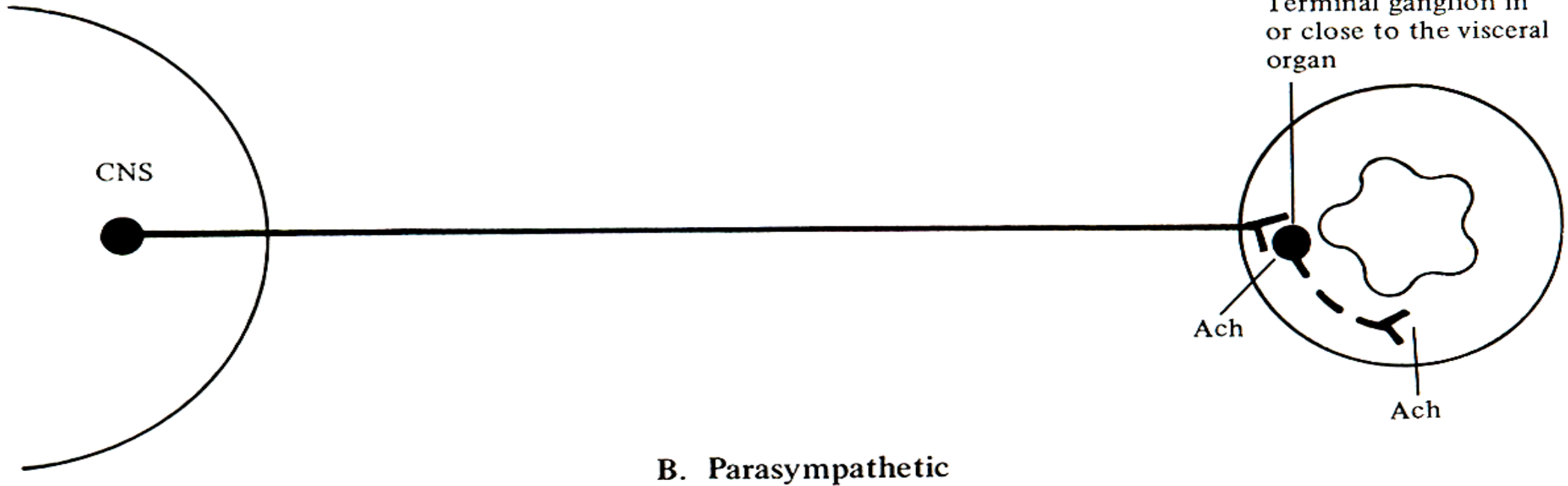
- ◆ Visceral motor system
  - ◆ Sympathetic (thoracolumbar) division
  - ◆ Parasympathetic (craniosacral) division
- ◆ Organization
  - ◆ 1<sup>st</sup> preganglionic neurons (inside CNS)
    - ◆ Sympathetic: intermediate column of spinal cord
    - ◆ Parasympathetic: brainstem
  - ◆ 2<sup>nd</sup> postganglionic neurons (outside CNS)
    - ◆ i.e. autonomic ganglion
  - ◆ Post-ganglionic fibers: terminating on effectors (smooth muscles, cardiac muscles, glands)



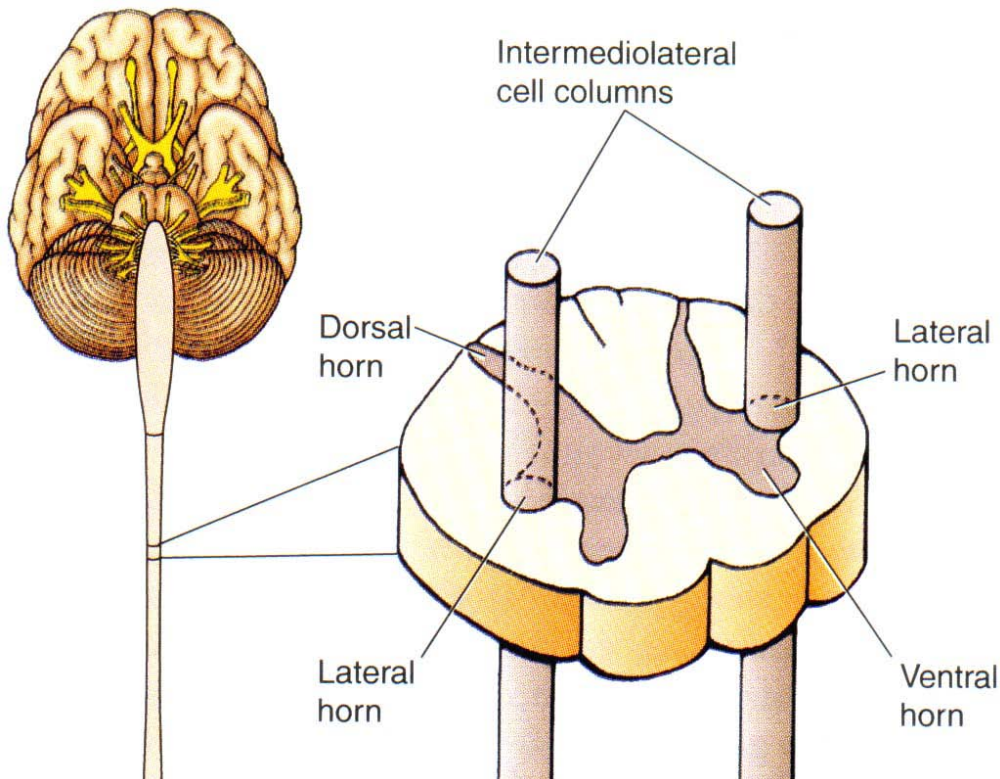
### A. Sympathetic



# ANS: organization



### B. Parasympathetic



# Sympathetic division

- ◆ Presynaptic neurons
  - ◆ Intermediate cell column (lateral horn)
  - ◆ T1-L2/3  
(Thoracolumbar)
- ◆ Postsynaptic neurons
  - ◆ Sympathic trunk, Paravertebral ganglia; Prevertebral ganglia

# Parasympathetic division

## ◆ Cranial parasympathetic outflow

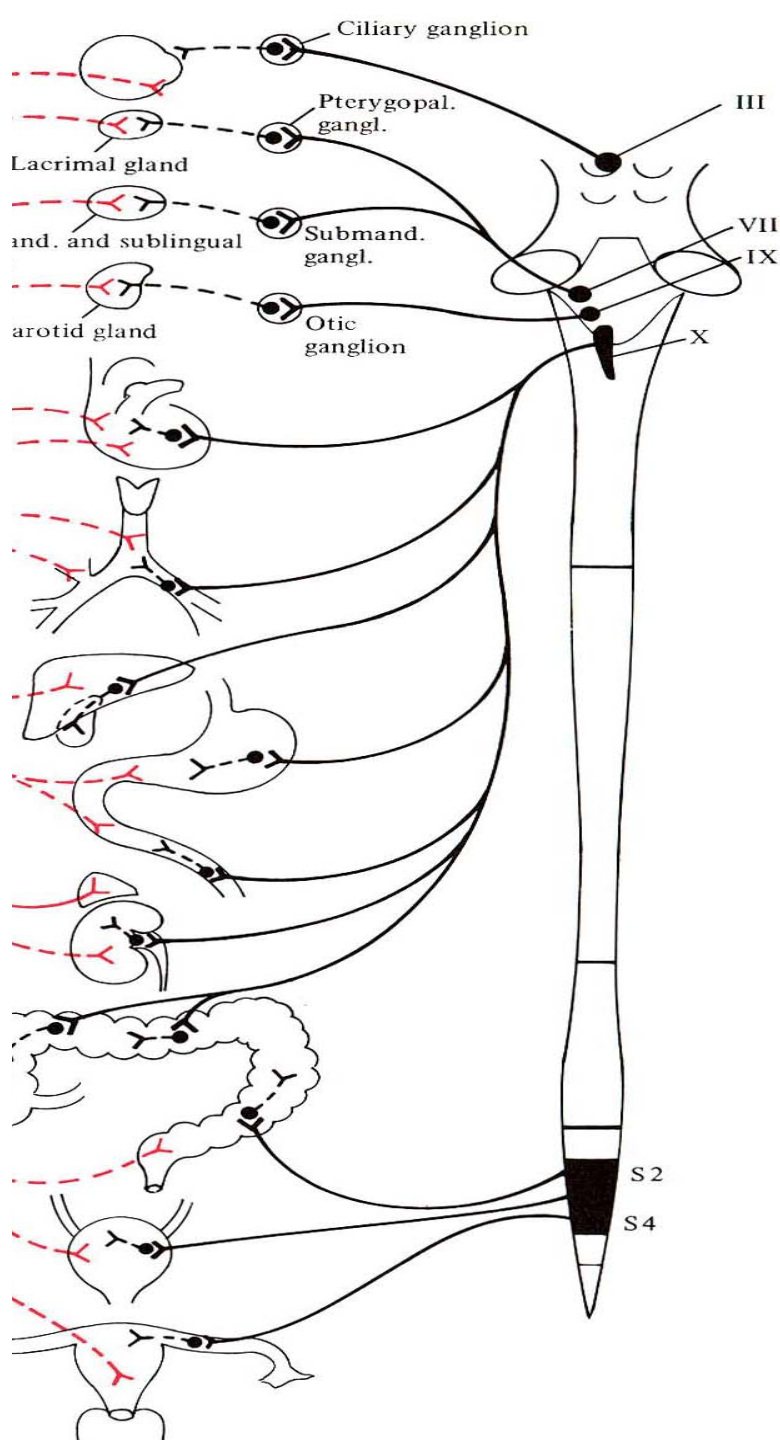
- ◆ Gray mater of brainstem

- ◆ cranial nerves 3, 7, 9, 10

## ◆ Sacral parasympathetic outflow

- ◆ Gray mater of spinal cord (S2-4)

- ◆ ventral roots of S2-4, ventral rami, pelvic splanchnic nerves



# Functions of ANS: Principles

- ◆ Sympathetic: catabolic, “flee or fight”
  - ◆ Sympathetic fibers to all vascularized tissues
- ◆ Parasympathetic: anabolic, “conserving”
- ◆ Gland secretion (except sweat glands):  
parasympathetically stimulated
- ◆ Vasoconstriction (except coronary arteries):  
sympathetically stimulated

# CNS: review

- ◆ Organization
  - ◆ Cerebral hemisphere
  - ◆ Brainstem, Cerebellum
- ◆ Meninges
  - ◆ Dura, Arachnoid, Pia
- ◆ Ventricular system and Cerebrospinal fluid
- ◆ Cerebral arteries: Willis circle

# PNS: Review

- ◆ Structure of PNS
  - ◆ Somatic vs. Autonomic fibers
  - ◆ Ventral vs. Dorsal roots; Ventral vs. Dorsal rami
  - ◆ Dermatome, Myotome
- ◆ Autonomic nerves
  - ◆ Organization
    - ◆ Presynaptic neurons, Postsynaptic ganglion
  - ◆ Sympathetic vs. Parasympathetic nerves